

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A system for assigning time slots in a packet communication system comprising a network-side apparatus and a plurality of terminal-side apparatuses connected to the network-side apparatus through a shared transmission medium, the network-side apparatus ~~being adapted to assign~~ assigning time slots to the terminal-side apparatuses, each of the terminal-side apparatuses ~~being adapted to transfer~~ transferring one or more packets over the shared transmission medium by using the time slots assigned thereto,

the terminal-side apparatus comprising:

buffering means for use in storing the packets to be transferred; and

notification means connected to said buffering means and the network-side apparatus, said notification means ~~being adapted to supply~~ supplying, to the network-side apparatus, information indicative of the number of the packets stored in said buffering means as packets information;

the network-side apparatus comprising:

control means connected to each of the terminal-side apparatuses, said control means ~~being adapted to assign~~ assigning, in response to the packets information supplied from each of the terminal-side apparatuses, time slots to the terminal-side apparatuses in accordance with a predetermined fairness criteria, the time slots being assigned as primarily assigned time slots, and

when one or more leftover time slots are present in at least one terminal-side apparatuses after the assignment of the primarily assigned time slots, then said control means:

designating the terminal-side apparatus(es) with such leftover time slot(s) as non-available terminal-side apparatus(es) for reassignment and the remaining terminal-side apparatus(es) as available terminal-side apparatus(es) for reassignment, and reassigning the leftover time slot(s) to the available terminal-side apparatus(es) for reassignment.

2. (Original) A system as claimed in Claim 1, wherein said control means compares the number of the primarily assigned time slots with the number of the packets stored, and designates the number of the primarily assigned time slots as the final number of the time slots assigned to the terminal-side apparatuses when the number of the primarily assigned time slots is smaller than the number of the packets stored for all terminal-side apparatuses.

3. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning the time slots equally to the terminal-side apparatuses.

4. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.

5. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the sum of maximum bandwidths for connections in the terminal-side apparatuses.

6. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the difference between the sum of maximum bandwidths and the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.

7. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the number of connections in the terminal-side apparatuses.

8. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.

9. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the sum of maximum bandwidths for connections in the terminal-side apparatuses.

10. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the difference between the sum of maximum bandwidths and the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.

11. (Original) A system as claimed in Claim 1, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the number of connections in the terminal-side apparatuses.

12. (Original) A system as claimed in Claim 1, wherein said control means controls, on an equivalent assignment, reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment.

13. (Original) A system as claimed in Claim 1, wherein said control means controls reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment, such that the value obtained by subtracting the number of the primarily assigned time slots from the number of the packets to be transferred becomes minimum in the available terminal-side apparatus(es) for reassignment.

14. (Original) A system as claimed in Claim 1, wherein said control means controls reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment in proportion to the number of the packets to be transferred.

15. (Original) A system as claimed in Claim 1, wherein the packet is a cell to be used in an asynchronous transfer mode.

16. (Currently Amended) A system for assigning time slots in a packet communication system comprising a network-side apparatus and a plurality of terminal-side apparatuses connected to the network-side apparatus through a shared transmission medium, the network-side apparatus ~~being adapted to assign~~ assigning time slots to the terminal-side apparatuses, each of the terminal-side apparatuses ~~being adapted to transfer~~ transferring one or more packets over the shared transmission medium by using the time slots assigned thereto,

the terminal-side apparatus comprising:

buffering means for use in storing the packets to be transferred; and

notification means connected to said buffering means and the network-side apparatus, said notification means ~~being adapted to supply~~ supplying, to the network-side apparatus, information indicative of the number of the packets stored in said buffering means as packets information;

the network-side apparatus comprising:

control means connected to each of the terminal-side apparatuses, said control means ~~being adapted to assign~~ assigning, in response to the packets information supplied from each of the terminal-side apparatuses time slots to the terminal-side apparatuses in accordance with a predetermined fairness criteria, the time slots being assigned as primarily assigned time slots, and

when one or more leftover time slots are present in at least one terminal-side apparatuses after the assignment of the primarily assigned time slots, then said control means:

designating the terminal-side apparatus(es) with such leftover time slot(s) as non-available terminal-side apparatus(es) for reassignment and the remaining terminal-side apparatus(es) as available terminal-side apparatus(es) for reassignment,

reassigning the leftover time slot(s) to the available terminal-side apparatus(es) for reassignment,

designating the sum of the differences between the number of the primarily assigned time slots to the non-available terminal-side apparatus(es) and the number of the packets stored, as the number of the leftover time slots to be reassigned,

making the number of the primarily assigned time slots to the non-available terminal-side apparatus(es) for reassignment, be identical to the number of the packets stored,

reassigning the leftover time slots to the available terminal-side apparatus(es) such that the number of the time slots to the available terminal-side apparatus(es) does not exceed the number of the packets stored, and

if the number of the time slots assigned becomes equal to the number of the packets stored for all available terminal-side apparatuses and at least one leftover time slot remains unassigned,

said control means:

assigning the remaining time slot(s) to all of the terminal-side apparatuses in accordance with the fairness criteria, and

using the sum of the primarily assigned time slots and the number of the leftover time slots reassigned, as a final number of the time slots assigned to the corresponding terminal-side apparatus.

17. (Currently Amended) A network-side apparatus connected to a plurality of terminal-side apparatuses through a shared transmission medium in a packet communication system, the network-side apparatus ~~being adapted to assign~~ assigning time slots to the terminal-side apparatuses, each of the terminal-side apparatuses having a buffer and ~~being adapted to transfer~~ transferring one or more packets over the shared transmission medium by using the time slots assigned thereto, the network-side apparatus comprising:

fairness assignment means connected to the terminal-side apparatuses, said fairness assignment means ~~being adapted to assign~~ assigning time slots to the terminal-side apparatuses in accordance with a predetermined fairness criteria, in response to information indicative of the number of the packets stored in the buffer; and

reassignment control means for use in, when one or more leftover time slots are present in at least one terminal-side apparatuses after the assignment of the primarily assigned time slots, designating the terminal-side apparatus(es) with such leftover time

slot(s) as non-available terminal-side apparatus(es) for reassignment and the remaining terminal-side apparatus(es) as available terminal-side apparatus(es) for reassignment, to control reassignment of the leftover time slot(s) to the available terminal-side apparatus(es) for reassignment.

18. (Original) A network-side apparatus as claimed in Claim 17, wherein said fairness assignment means comprises:

an assignment information management table for managing, for each of the terminal-side apparatuses, packets information corresponding to information indicative of the number of the packets stored in the terminal-side apparatus and supplied from the terminal-side apparatus, assigned time slots information corresponding to information indicative of the number of time slots assigned to the terminal-side apparatus, and identifier information indicating whether each of the terminal-side apparatus is available for reassignment or not; and

a fairness guarantee assignment circuit for assigning the time slots to all or some of the terminal-side apparatuses in accordance with the fairness criteria at the timing when it is necessary to change assignment of the time slots, to write the number of the time slots assigned to the terminal-side apparatuses into the assignment information management table.

19. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning the time slots equally to the terminal-side apparatuses.

20. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.

21. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the sum of maximum bandwidths for connections in the terminal-side apparatuses.

22. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the difference between the sum of maximum bandwidths and the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.

23. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the number of connections in the terminal-side apparatuses.

24. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.

25. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the sum of maximum bandwidths for connections in the terminal-side apparatuses.

26. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the difference between the sum of maximum bandwidths and the sum of guaranteed minimum bandwidths for connections in the terminal-side apparatuses.



27. (Original) A network-side apparatus as claimed in Claim 17, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the number of connections in the terminal-side apparatuses.

28. (Original) A network-side apparatus as claimed in Claim 17, wherein said control means controls, on an equivalent assignment, reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment.

29. (Original) A network-side apparatus as claimed in Claim 17, wherein said control means controls reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment, such that the value obtained by subtracting the number of the primarily assigned time slots from the number of the packets stored becomes equal or similar to each other in the available terminal-side apparatus(es) for reassignment.

30. (Original) A network-side apparatus as claimed in Claim 17, wherein said control means controls reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment in proportion to the number of the packets to be transferred.

31. (Original) A network-side apparatus as claimed in Claim 17, wherein the packet is a cell to be used in an asynchronous transfer mode.

32. (Currently Amended) A network-side apparatus connected to a plurality of terminal-side apparatuses through a shared transmission medium in a packet communication system to assign time slots to the terminal-side apparatuses, the terminal-side apparatus ~~being adapted to transfer~~ transferring one or more packets over the shared transmission medium by using the time slots assigned thereto, each of the terminal-side apparatuses having buffering means for use in storing the packets to be transferred and

notification means connected to the buffering means and the network-side apparatus, the notification means ~~being adapted to supply~~ supplying, to the network-side apparatus, information indicative of the number of the packets stored in the buffering means as packets information,

the network-side apparatus further comprising:

fairness assignment means connected to the terminal-side apparatuses, said fairness assignment means ~~being adapted to assign~~ assigning, in response to the packets information, time slots to the terminal-side apparatuses in accordance with a predetermined fairness criteria, the time slots being assigned as primarily assigned time slots,

reassignment control means for use in designating, when one or more leftover time slots are present in at least one terminal-side apparatuses after the assignment of the primarily assigned time slots, the terminal-side apparatus(es) with such leftover time slot(s) as non-available terminal-side apparatus(es) for reassignment and the remaining terminal-side apparatus(es) as available terminal-side apparatus(es) for reassignment, and reassigning the leftover time slot(s) to the available terminal-side apparatus(es) for reassignment,

an assignment information management table for managing, for each of the terminal-side apparatuses, packets information corresponding to information indicative of the number of the packets stored in the terminal-side apparatus, the packets information being supplied from the terminal-side apparatus, assigned time slots information corresponding to information indicative of the number of the time slots assigned to the terminal-side apparatus as the number of the primarily assigned time slots, and identifier

information indicating whether each of the terminal-side apparatus is available for reassignment or not; and

an assigned time slots transmission circuit for use in supplying the assigned time slots information to the terminal-side apparatuses,

said fairness assignment means comprising a fairness guarantee assignment circuit for assigning the time slots to all or some of the terminal-side apparatuses in accordance with the fairness criteria at the timing when it is necessary to change assignment of the time slots, to write the number of the primarily assigned time slots into said assignment information management table;

said reassignment control means comprising:

a reassignment determination circuit for use in obtaining, for each of the terminal-side apparatuses, the assigned time slots information and the packets information by means of looking up said assignment information management table, to compare the number of the primarily assigned time slots and the number of the packets stored for each of the terminal-side apparatuses, said reassignment determination circuit determining to perform reassignment when the number of the primarily assigned time slots exceeds the number of the packets stored for at least one terminal-side apparatus, said reassignment determination circuit determining not to perform reassignment when the number of the primarily assigned time slots is smaller than the number of the packets stored for all terminal-side apparatuses, and in designating the number of the primarily assigned time slots as the number of the time slots assigned to the terminal-side apparatus to send the determined number of the time slots to the assigned time slots transmission circuit;

a reassigned terminal-side apparatus determination circuit for use in obtaining, for each of the terminal-side apparatuses, the assigned time slots information

and the packets information by means of looking up said assignment information management table when said reassignment determination circuit determines to perform reassignment, and in designating the terminal-side apparatus(es) as available terminal-side apparatus(es) for reassignment where the number of the primarily assigned time slots is smaller than the number of the packets stored and the remaining terminal-side apparatus(es) as non-available terminal-side apparatus(es), to write in said assignment information management table an identifier indicative of availability of the terminal-side apparatus for the reassignment;

a reassigned time slots determination circuit for use in obtaining, for the non-available terminal-side apparatus(es), the assigned time slots information and the packets information by means of looking up said assignment information management table, and designating the sum of the differences between the number of the primarily assigned time slots and the number of the packets stored as the number of the leftover time slots to be reassigned, to update said assignment information management table with the number of the packets stored applied to the number of the primarily assigned time slots for the non-available terminal-side apparatus(es); and

an efficiency improvement reassignment circuit connected to assigned time slots transmission circuit, said efficiency improvement reassignment circuit for use in:

obtaining the packets information for the available terminal-side apparatus(es) for reassignment and the assigned time slots information for all terminal-side apparatuses by means of looking up said assignment information management table, and reassign the number of the leftover time slots to the available terminal-side apparatus(es) for reassignment such that the number of the time slots assigned to the available terminal-side apparatus(es) for reassignment is equal to or smaller than the

number of the packets stored, and as a result of this reassignment, if the number of the time slots assigned to the available terminal-side apparatus(es) for reassignment is larger than the number of the packets stored, then designating the available terminal-side apparatus(es) as non-available terminal-side apparatus(es) for reassignment with the number of the packets stored used as the number of the time slots assigned thereto, and reassigning, to the available terminal-side apparatus(es) for reassignment, the difference between the number of the time slots already assigned to the available terminal-side apparatus for reassignment and the number of the packets stored as the number of the leftover time slots, which is repeated until the number of the time slots assigned to the available terminal-side apparatuses becomes equal to or smaller than the number of the packets stored for all available terminal-side apparatuses, and

assigning, if no terminal-side apparatus is available for reassignment before completion of the reassignment even though one or more time slots still remain without being assigned, all leftover time slots for reassignment to the terminal-side apparatuses in accordance with the fairness criteria determining, as the number of the time slots assigned to the terminal-side apparatuses, the sum of the number of the primarily assigned time slots obtained from said assignment information management table and the number of the leftover time slots already reassigned, to send the determined number of the time slots to the assigned time slots transmission circuit.

33. (Currently Amended) A method for assigning time slots in a packet communication system comprising a network-side apparatus and a plurality of terminal-side apparatuses connected to the network-side apparatus through a shared transmission medium, the network-side apparatus having control means and ~~being adapted to assign~~ assigning time slots to the terminal-side apparatuses, each of the terminal-side apparatuses

having a buffer and ~~being adapted to transfer~~ transferring one or more packets to the shared transmission medium by using the time slots assigned thereto, the method comprising the steps of:

supplying, from each of the terminal-side apparatuses, information indicative of the number of the packets stored in the buffer as packets information; and

assigning, by the control means in the network-side apparatus, in response to the packets information supplied from each of the terminal-side apparatuses, time slots to the terminal-side apparatuses in accordance with a predetermined fairness criteria, the time slots being assigned as primarily assigned time slots; and

controlling, when one or more leftover time slots are present in at least one terminal-side apparatuses after the assignment of the primarily assigned time slots, to designate the terminal-side apparatus(es) with such leftover time slot(s) as non-available terminal-side apparatus(es) for reassignment and the remaining terminal-side apparatus(es) as available terminal-side apparatus(es) for reassignment, and ~~reass~~ reassigning the leftover time slot(s) to the available terminal-side apparatus(es) for reassignment.

34. (Original) A method as claimed in Claim 33, wherein the control means compares the number of the primarily assigned time slots with the number of the packets stored, and designates the number of the primarily assigned time slots as the final number of the time slots assigned to the terminal-side apparatuses when the number of the primarily assigned time slots is smaller than the number of the packets stored for all terminal-side apparatuses.

35. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning the time slots equally to the terminal-side apparatuses.

36. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the sum of guaranteed minimum bandwidths for the connections in the terminal-side apparatuses.

37. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the sum of maximum bandwidths for the connections in the terminal-side apparatuses.

38. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the difference between the sum of maximum bandwidths and the sum of guaranteed minimum bandwidths for the connections in the terminal-side apparatuses.

39. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning the time slots to the terminal-side apparatuses in proportion to the number of connections in the terminal-side apparatuses.

40. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the sum of guaranteed minimum bandwidths for the connections in the terminal-side apparatuses.

41. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the sum of maximum bandwidths for the connections in the terminal-side apparatuses.

42. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then

assigning the remaining time slots in proportion to the difference between the sum of maximum bandwidths and the sum of guaranteed minimum bandwidths for the connections in the terminal-side apparatuses.

43. (Original) A method as claimed in Claim 33, wherein the fairness criteria is for assigning a part of total time slots equally to the terminal-side apparatuses and then assigning the remaining time slots in proportion to the number of connections in the terminal-side apparatuses.

44. (Original) A method as claimed in Claim 33, wherein the control means controls, on an equivalent assignment, reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment.

45. (Original) A method as claimed in Claim 33, wherein the control means controls reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment, such that the value obtained by subtracting the number of the primarily assigned time slots from the number of the packets stored becomes equal or similar to each other in the available terminal-side apparatus(es) for reassignment.

46. (Original) A method as claimed in Claim 33, wherein the control means controls reassignment of the leftover time slots to the available terminal-side apparatus(es) for reassignment in proportion to the number of the packets to be transferred.

47. (Original) A method as claimed in Claim 33, wherein the packet is a cell to be used in an asynchronous transfer mode.

48. (Original) A method as claimed in Claim 33, wherein the controlling step comprises the steps of



designating the sum of the differences between the number of the primarily assigned time slots to the non-available terminal-side apparatus(es) and the number of the packets stored, as the number of the leftover time slots to be reassigned,

making the number of the primarily assigned time slots to the non-available terminal-side apparatus(es) for reassignment, be identical to the number of the packets stored,

reassigning the leftover time slots to the available terminal-side apparatus(es) such that the number of the time slots to the available terminal-side apparatus(es) does not exceed the number of the packets stored, and

if the number of the time slots assigned becomes equal to the number of the packets stored for all available terminal-side apparatuses and at least one leftover time slot remains unassigned,

assigning the remaining time slot(s) to all of the terminal-side apparatuses in accordance with the fairness criteria, and

using the sum of the primarily assigned time slots and the number of the leftover time slots reassigned, as a final number of the time slots assigned to the corresponding terminal-side apparatus.